

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application: Hui et al.

Serial No.: 10/799,413

Filed: March 12, 2004

Art Unit: 2814

Examiner: Mai, Anh D.

Title: AVOIDING FIELD OXIDE GOUGING IN SHALLOW
TRENCH ISOLATION (STI) REGIONS

REPLY BRIEF UNDER 37 C.F.R. §41.41

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This Reply Brief is being submitted in response to the Examiner's Answer dated May 18, 2006, with a two-month statutory period for response set to expire on July 18, 2006.

I. RESPONSE TO EXAMINER'S ARGUMENTS

A. Response to Examiner's argument that claims 1-5 and 10-15 are properly rejected under 35 U.S.C. §112, second paragraph, as discussed on pages 8-10 of Examiner's Answer.

The Examiner asserts that claims 1-5 and 10-15 are properly rejected under 35 U.S.C. §112, second paragraph, because one of ordinary skill in the art would allegedly be required to find "unclaimed elements to understand the scope of the claim." Examiner's Answer, page 9. Appellants respectfully traverse the assertion that (1) a person of ordinary skill in the art could not determine the scope of the claimed subject matter in claims 1 and 10 that the Examiner contends is indefinite and that (2) Appellants referred to "unclaimed elements" in the Specification as support for the claim language in claims 1 and 10 that the Examiner contends is indefinite.

As stated in Appellants' Appeal Brief, Appellants respectfully contend that the limitation of "etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 1 and similarly in claim 10 can be determined by one having ordinary skill in the art. Appellants respectfully directed the Board's attention to at least page 8, lines 1-3 of the Specification and Figure 3B as illustrating the etching of a portion of the anti-reflective coating layer over the STI region and leaving a remaining portion of the anti-reflective coating layer over the STI region and extending beyond the boundaries of the STI region. As illustrated in Figure 3B, a portion of the anti-reflective coating layer 34 was etched over the STI region 14 leaving a remaining portion of the anti-reflective coating layer 34 over the STI region 14. Furthermore, Figure 3B illustrates that the anti-reflective coating layer 34 extends beyond the boundaries of the STI region 14. Clearly, the scope of the above-cited claimed subject matter can be determined by one having ordinary skill in the art. Hence, claims 1-5 and 10-15 are allowable under 35 U.S.C. §112, second paragraph.

Further, Appellants did not cite to any additional elements in the above-cited passages in Appellants' Specification that is necessary for understanding the above-cited claim language. As indicated in the previous paragraph, the passages cited by Appellants in Appellants' Specification specifically address the elements in the above-cited claim language.

Further, the Examiner states:

As clearly indicated that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 U.S.P.Q.2d 1057 (Fed. Cir. 1993). It is noted that the features upon which applicant relies (i.e. a portion of the anti-reflective coating layer 34 was etched over the STI region 14) are not recited in the rejected claim(s). Examiner's Answer, page 9.

Appellants are not proposing to read any limitations into the claims. Appellants were simply identifying the passages in the Specification that support the claim language thereby illustrating that a person of ordinary skill in the art would be able to determine the scope of the claimed subject matter.

Further, Appellants respectfully traverse the assertion that Appellants have directed the Board to features not recited in the rejected claims. As stated in Appellants' Appeal Brief, Appellants respectfully contend that the limitation of "etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 1 and similarly in claim 10 can be determined by one having ordinary skill in the art. Appellants' Brief, page 5. Appellants respectfully directed the Board's attention to at least page 8, lines 1-3 of the Specification and Figure 3B as illustrating the etching of a portion of the anti-reflective coating layer over the STI region and leaving a remaining portion of the anti-reflective coating layer over the STI region and extending beyond the boundaries of the STI region. Appellants Appeal Brief, page 5. As illustrated in Figure 3B, a portion of the anti-reflective coating layer 34 was

etched over the STI region 14 leaving a remaining portion of the anti-reflective coating layer 34 over the STI region 14. Appellants Appeal Brief, page 5. Furthermore, Figure 3B illustrates that the anti-reflective coating layer 34 extends beyond the boundaries of the STI region 14. Appellants Appeal Brief, page 5. Hence, Appellants have pointed to elements (anti-reflective coating layer 34 and STI region 14) that were specifically stated in the claim language that the Examiner asserts as being indefinite. Appellants were not directing the Board to features not recited in the rejected claims as asserted by the Examiner. Hence, claims 1-5 and 10-15 are allowable under 35 U.S.C. §112, second paragraph.

With respect to the limitation of "etching an exposed portion of said polysilicon layer and said gate oxide layer over said STI region leaving a remaining portion of said polysilicon layer and said gate oxide layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 1, the Examiner incorrectly asserts that this limitation is also recited in claim 10. Examiner's Answer, pages 9-10. Further, Appellants had previously directed the Board to Figure 3B to illustrate an exposed portion of the polysilicon layer and the gate oxide layer over the STI region. Appellants' Appeal Brief, page 8. The Examiner asserts that Figure 3B does not show an exposed portion of the polysilicon layer and the gate oxide layer over the STI region. Examiner's Answer, page 10. Appellants again direct the Board's attention to Figure 3B which shows that the mask layer (element 36) and the ARC layer (element 34) have been etched to the polysilicon layer (element 32). The exposed portion of the polysilicon layer (element 32) refers to the area of the polysilicon layer (element 32) that no longer has any ARC layer (element 34) above it. Etching of the "gate oxide layer" (element 30) "over the STI region" (element 14) refers to that portion of the gate oxide layer (element 30) that lies underneath the exposed portion of the polysilicon layer (element 32) and above the STI region (element 14). Hence, Figure 3B illustrates an exposed portion of the polysilicon layer and the gate oxide layer over the STI region that will be etched. Figure 3C illustrates the etching of these portions leaving a remaining portion of the polysilicon layer and the gate oxide layer over the STI region and extending beyond the boundaries

of the STI region. Consequently, the scope of the above-cited claimed subject matter can be determined by one having ordinary skill in the art. Hence, claims 1-5 are allowable under 35 U.S.C. §112, second paragraph.

- B. Response to Examiner's argument that Yang teaches "etching a trench in an STI region; filling said trench with an insulating material" as recited in claim 10, as discussed on pages 10-11 of Examiner's Answer.

The Examiner states:

Appellant appears to agree with this Office that Yang does teach that trench isolation structure, etched and filled, can be used instead of field oxidation structure or LOCOS. Appellant seems only to contend that the trench isolation of Yang is not the 'shallow' trench isolation. (emphasis added). Firstly, the term 'shallow' is a relative term and does not include or exclude any depth. Secondly, the term 'STI' is well known in the art to identify an isolation structure formed by trench instead of LOCOS. One having ordinary skill in the art should have no difficulty to confirm the isolation structure 76 of Yang as an STI. Examiner's Answer, page 11.

Appellants respectfully traverse the assertion that Appellants agree with the Examiner that Yang teaches a trench isolation structure that is etched and filled. As stated in Appellants' Appeal Brief, Appellants respectfully asserted that there was no language in Yang that teaches filling of the trench (Examiner asserts that element 76 of Yang teaches the trench claimed) with an insulating material. Appellants' Appeal Brief, page 11.

Further, Appellants did not state that Yang teaches LOCOS. There is no language in Yang that teaches LOCOS.

Further, while STI is known in the art, the Examiner is required to show either Hsu or Yang as teaching an STI region in order to establish a *prima facie* case of obviousness in rejecting claim 10. M.P.E.P. §2143. The Examiner has not shown either Hsu or Yang as teaching an STI region and thus has not established a *prima facie* case of obviousness in rejecting claim 10. *Id.*

Further, the Examiner asserts that one having ordinary skill in the art should have no difficulty to confirm that the isolation structure 76 of Yang is an STI. Examiner's Answer, page 11. The Examiner has not provided any motivation for modifying the isolation structure 76 of Yang as an STI region. In order to establish a *prima facie* case of obviousness, the Examiner must provide some suggestion or motivation, either in the references themselves, the knowledge of one of ordinary skill in the art, or, in some case, the nature of the problem to be solved, to modify the reference or to combine reference teachings. *See In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). The Examiner has not provided any such motivation and therefore has not established a *prima facie* case of obviousness in rejecting claim 10. *Id.*

- C. Response to Examiner's argument that Hsu and Yang, taken in combination, teach "depositing an anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 10, as discussed on pages 11-12 of Examiner's Answer.

The Examiner asserts that Hsu and Yang, taken in combination, teach "depositing an anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 10. The Examiner had previously cited elements 241a and 230 of Hsu as teaching the above-cited claim limitation. Office Action (10/18/2005), page 4. Consequently, Appellants only addressed Hsu in their traversal of the Examiner's rejection for this claim limitation. The Examiner responds to Appellants' argument by stating that Appellants are attacking references individually. Examiner's Answer, page 12. Appellants were not attacking references individually. If the Examiner cites to a particular passage or elements in a single reference as teaching the claim limitation, then when Appellants respond by asserting that the single reference does not teach that claim limitation, that does not constitute attacking references individually.

The Examiner now asserts that element 230 of Hsu can be replaced by element 76 of Yang. Examiner's Answer, page 11. However, the Examiner does not provide any motivation for modifying Hsu by replacing element 230 of Hsu with element 76 of Yang. As stated above, in order to establish a *prima facie* case of obviousness, the Examiner

must provide some suggestion or motivation, either in the references themselves, the knowledge of one of ordinary skill in the art, or, in some case, the nature of the problem to be solved, to modify the reference or to combine reference teachings. *See In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). Since the Examiner has not provided any such motivation for modifying Hsu by replacing element 230 of Hsu with element 76 of Yang, the Examiner has not established a *prima facie* case of obviousness in rejecting claim 10. *Id.*

- D. Response to Examiner's argument that Hsu and Yang, taken in combination, teach "etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 10, as discussed on pages 11-12 of Examiner's Answer.

The Examiner asserts that Hsu and Yang, taken in combination, teach "etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region" as recited in claim 10. The Examiner had previously cited elements 241a and 230 of Hsu as teaching the above-cited claim limitation. Office Action (10/18/2005), page 5. Consequently, Appellants only addressed Hsu in their traversal of the Examiner's rejection for this claim limitation. The Examiner responds to Appellants' argument by stating that Appellants are attacking references individually. Examiner's Answer, page 12. Appellants were not attacking references individually. If the Examiner cites to a particular passage or elements in a single reference as teaching the claim limitation, then when Appellants respond by asserting that the single reference does not teach that claim limitation, that does not constitute attacking references individually.

The Examiner now asserts that element 230 of Hsu can be replaced by element 76 of Yang. Examiner's Answer, page 11. However, the Examiner does not provide any motivation for modifying Hsu by replacing element 230 of Hsu with element 76 of Yang. As stated above, in order to establish a *prima facie* case of obviousness, the Examiner

must provide some suggestion or motivation, either in the references themselves, the knowledge of one of ordinary skill in the art, or, in some case, the nature of the problem to be solved, to modify the reference or to combine reference teachings. *See In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). Since the Examiner has not provided any such motivation for modifying Hsu by replacing element 230 of Hsu with element 76 of Yang, the Examiner has not established a *prima facie* case of obviousness in rejecting claim 10. *Id.*

- E. Response to Examiner's remarks in connection with the limitation of "depositing a protective cap covering said STI region and extending beyond the boundaries of said STI region, wherein said protective cap covers said remaining portion of said anti-reflective coating layer and said insulating material over said STI region" as recited in claim 10, as discussed on page 12 of Examiner's Answer.

The Examiner asserts that Hsu and Yang, taken in combination, teach "depositing a protective cap covering said STI region and extending beyond the boundaries of said STI region, wherein said protective cap covers said remaining portion of said anti-reflective coating layer and said insulating material over said STI region" as recited in claim 10. The Examiner had previously cited to elements 230, 241a and 246 of Hsu as teaching the above-cited claim limitation. Office Action (10/18/2005), page 5. Appellants asserted that the Examiner was citing to element 230 of Hsu as teaching both the STI region and the insulating material referred to in the above-cited claim limitation. Appellants' Appeal Brief, pages 12-13. The Examiner asserts that the insulating material fills the STI region. Examiner's Answer, page 12. Appellants agree that a trench is filled with an insulating material. The Examiner continues by citing to element 76 of Yang as material filling a trench. Examiner's Answer, page 12. As now understood by Appellants, the Examiner is citing to element 76 of Yang as being the insulating material referred to in the above-cited claim limitation. However, element 76 of Yang refers to a trench isolation structure. Column 6, lines 24-26. While the trench isolation structure 76 of Yang may include isolation material, Figure 4 of Yang, which discloses trench isolation structure 76, does not illustrate trench isolation structure 76 as including

isolation material. Further, the Examiner has not provided any motivation for modifying Hsu with Yang to use element 76 of Yang as insulating material in isolation structure 230 of Hsu. As stated above, in order to establish a *prima facie* case of obviousness, the Examiner must provide some suggestion or motivation, either in the references themselves, the knowledge of one of ordinary skill in the art, or, in some case, the nature of the problem to be solved, to modify the reference or to combine reference teachings. *See In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). Since the Examiner has not provided any such motivation for modifying Hsu with Yang to use element 76 of Yang as insulating material in isolation structure 230 of Hsu, the Examiner has not established a *prima facie* case of obviousness in rejecting claim 10. *Id.*

F. Response to Examiner's remarks in connection with "etching a portion of said protective cap to expose said remaining portion of said anti-reflective coating layer while maintaining protection of said insulating material" as recited in claim 11, as discussed on page 13 of Examiner's Answer.

The Examiner asserts, in connection with the rejection of "etching a portion of said protective cap to expose said remaining portion of said anti-reflective coating layer while maintaining protection of said insulating material," as recited in claim 11, that Appellants argue that the references cited by the Examiner must use the exact same terms as recited by the claim. Examiner's Answer, page 13. Appellants respectfully disagree. Appellants have never asserted that the references cited by the Examiner must use the exact same terms as recited by the claim. Further, the Examiner appears to assert that "protective cap" and "anti-reflective coating" are the same element. Examiner's Answer, page 13. Appellants respectfully traverse the assertion that "protective cap" and "anti-reflective coating" are the same element. In fact, claim 11 specifically refers to these terms as separate elements. Thus, as a result of the foregoing, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 11, since the Examiner is relying upon incorrect, factual predicates in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

G. Response to Examiner's argument that claim 14 is properly rejected, as discussed on page 14 of Examiner's Answer

Appellants respectfully assert that Hsu and Yang, taken singly or in combination, do not teach or suggest "wherein said remaining portion of said anti-reflective coating layer is etched using a plasma etch process" as recited in claim 14. The Examiner had previously not addressed this claim limitation. The Examiner now asserts that element 60 of Yang can be removed using a dry etch process. Examiner's Answer, page 14. The Examiner further asserts that dry etch is known in the art for plasma etch as opposed to wet etching. Examiner's Answer, page 14. Appellants respectfully traverse.

Yang does not teach removing film 60 using a dry etch process. In fact, Yang teaches the complete opposite. Yang teaches etching film 60 by wet etching the film using hot phosphoric acid. Column 6, lines 29-30. The Examiner had asserted that dry etch is known in the art for plasma etch as opposed to wet etching. However, Yang teaches removing film 60 using wet etching as opposed to a plasma etch. Hence, Yang does not teach removing film 60 using a dry etch process. Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 14, since the Examiner is relying upon incorrect, factual predicates in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

Further, the Examiner must provide a basis in fact and/or technical reasoning to support the assertion that Yang can be modified to remove film 60 using a plasma etch process. *See Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). That is, the Examiner must provide extrinsic evidence that must make clear that Yang can be modified to remove film 60 using a plasma etch process, and that it would be so recognized by persons of ordinary skill. *See In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). Since the Examiner has not provided any such objective evidence, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 14. M.P.E.P. §2143.

Further, the Examiner is ignoring claim language. All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); M.P.E.P. §2143.03. Claim 14 recites "wherein said remaining portion of said anti-reflective coating layer is etched using a plasma etch process." Since the Examiner has not cited to any passage in either Hsu or Yang as teaching all the terms in the above-cited claim limitation, the Examiner has not established a *prima facie* case of obviousness in rejecting claim 14. M.P.E.P. §2143.

H. Response to Examiner's argument that claim 15 is properly rejected, as discussed on page 14 of Examiner's Answer

Appellants respectfully assert that Hsu and Yang, taken singly or in combination, do not teach or suggest "wherein said insulating material comprises thermal oxide" as recited in claim 15. The Examiner had previously not addressed this claim limitation. The Examiner now asserts that that isolation structure 230 of Hsu comprises thermal oxide. Examiner's Answer, page 14. Appellants respectfully traverse.

There is no language in Hsu that teaches that isolation structure 230 comprises thermal oxide. The Examiner has not pointed to any passage in Hsu that teaches that isolation structure 230 comprises thermal oxide. Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 15, since the Examiner is relying upon incorrect, factual predicates in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

I. Response to Examiner's assertion that the Examiner provided appropriate motivation for modifying Hsu with Yang to include the missing limitation of claim 10, as discussed on pages 14-15 of Examiner's Answer.

The Examiner asserts that Appellants admit that Yang has provided the missing element of Hsu, replacing STI for field isolation. Examiner's Answer, page 14. Appellants respectfully traverse. Appellants have made no such assertion. Appellants are

only citing the Examiner's assertions in the first full paragraph on page 18 of Appellants' Appeal Brief.

J. Response to Examiner's assertion that Tripsas teaches "wherein said photoresist material has a thickness of about 800Å to 1200Å" as recited in claim 13, as discussed on pages 15-16 of Examiner's Answer.

Appellants respectfully assert that Hsu, Yang and Tripsas, taken singly or in combination, do not teach or suggest "wherein said photoresist material has a thickness of about 800Å to 1200Å" as recited in claim 13. The Examiner cites element 40 of Tripsas as teaching a protective cap that includes photoresist material with a thickness of 600Å to 1100Å. Office Action (10/18/2005), page 7. Appellants had previously noted that the Examiner had not cited to any passage in Tripsas as evidence that element 40 has a thickness of 600Å to 1100Å. Appellants' Appeal Brief, page 21. Appellants have further stated that upon review of Tripsas, Appellants could not locate any passage that indicates the thickness of element 40. Appellants' Appeal Brief, page 21. The Examiner now asserts that column 6, lines 57-67 of Tripsas teaches a thickness of 600Å to 1100Å. Examiner's Answer, page 15. Appellants respectfully traverse the assertion that Tripsas teaches a photoresist material having a thickness of about 800Å to 1200Å.

Tripsas instead teaches that the initial thickness floating gates 16a-c, including higher regions 41, is between about 600 and about 11 Angstroms. Column 6, lines 65-67. Hence, Tripsas teaches that the initial thickness of floating gates 16a-c and not layer 40 is between about 600 and about 1100 Angstroms. Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 13, since the Examiner is relying upon incorrect, factual predicates in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

Further, the Examiner concludes that since the initial thickness of floating gates 16a-c is between about 600 and about 1100 Angstroms, then layer 40 should at least have this thickness. Examiner's Answer, pages 15-16. Appellants respectfully traverse. As illustrated in Figure 3a and 3b, layer 40 does not have a thickness anywhere near the

thickness of floating gates 16a-c. Further, the Examiner must provide a basis in fact and/or technical reasoning to support the conclusion that since the initial thickness of floating gates 16a-c of Tripsas is between about 600 and about 1100 Angstroms, then layer 40 of Tripsas should have at least have this thickness. *See Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). That is, the Examiner must provide extrinsic evidence that must make clear that since the initial thickness of floating gates 16a-c of Tripsas is between about 600 and about 1100 Angstroms, then layer 40 of Tripsas should have at least have this thickness, and that it would be so recognized by persons of ordinary skill. *See In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). Since the Examiner has not provided any such objective evidence, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 13. M.P.E.P. §2143.

- K. Examiner asserts that he is not relying upon his own subjective opinion in modifying Hsu to include the missing claim limitations of claims 12 and 13, as discussed on page 16 of Examiner's Answer.

Appellants had pointed out in Appellants' Appeal Brief that the Examiner had not indicated the source of the Examiner's motivation and that the Examiner was in essence relying upon his own subjective opinion. Appellants' Appeal Brief, page 22. The Examiner disagrees but appears to be relying upon his own personal experience in a laboratory as support for this motivation. Examiner's Answer, page 16. The Examiner must provide objective evidence as to why one of ordinary skill in the art would modify Hsu to include the missing limitations of claims 12 and 13. *In re Lee*, 61 U.S.P.Q.2d 1430, 1434 (Fed. Cir. 2002). Instead, the Examiner is relying upon his own subjective opinion which is insufficient to establish a *prima facie* case of obviousness in rejecting claims 12 and 13. *Id.*

- L. Other matters raised by the Examiner.

All other matters raised by the Examiner have been adequately addressed above and in Appellants' Appeal Brief and therefore will not be addressed herein for the sake of brevity.

II. CONCLUSION

For the reasons stated above and in Appellants' Appeal Brief, Appellants respectfully assert that the rejections of claims 1-5 and 10-15 are in error. Appellants respectfully request reversal of the rejections and allowance of claims 1-5 and 10-15.

Respectfully submitted,

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